In the teaching of photography to students the tendency has been to lay great emphasis on the chemistry of the subject while the physics of photography, which is at least as important as the chemistry, has too often been ignored. Dr. Roebuck has approached the subject from the standpoint of the physicist rather than from that of the chemist, with the result that in this book there is given a clear and valuable exposition of the elementary principles of sensitometry, that is, of the properties of photographic material and its behavior during exposure and development.

The chemistry of the book is distinctly weak, there is practically no discussion of the chemistry of development, and the few equations given for the action of developers are very much open to question. There are also a few obvious errors in chemistry such as the statement that Stas was a German, or that hydrochloric acid can be added to silver nitrate in order to produce an acid emulsion.

In the portion of the book dealing with general theory the author commences with a brief chapter on the historical development of the subject and then deals with the sensitometry of the gelatine dry plate. A short chapter then discusses the subject of color sensitiveness, and another, theories of the latent image. Further chapters deal with negative defects, a very practical chapter indeed, positive processes, lenses, color photography, and the general principles of composition.

The second part of the book consists of a laboratory manual containing a series of experiments to be performed by the student. This will be very valuable to any teacher arranging a course in photography and a student who has worked thoroughly through the course, repeating the more elementary portions several times, will have had a good training in the elements of the subject.

On the whole the book forms a valuable addition to the scanty list of modern works on photography and is to be recommended to all those who are interested in the scientific side of the subject.

C. E. K. MEES

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THE PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

THE first number of Volume 4 of the *Proceedings of the National Academy of Sciences* contains the following articles:

The Basal Katabolism of Cattle and Other Species: Henry P. Armsby, J. August Fries and Winfred W. Braman, Institute of Animal Nutrition, the Pennsylvania State College. The results show that the basal katabolism of different species is substantially proportional to their body surface.

The Location of the Sun's Magnetic Axis: F. H. Seares, A. van Maanen and F. Ellerman, Mount Wilson Solar Observatory, Carnegie Institution of Washington. In extension of the work of George E. Hale, a large number of observations were undertaken to determine the position of the sun's magnetic axis, which is found to lie near the axis of rotation at an inclination of about 6°, and to revolve about the axis of rotation in about 32 days.

Resonance and Ionization Potentials for Electrons in Cadmium, Zinc and Potassium Vapors: John T. Tate and Paul D. Foote, University of Minnesota and Bureau of Standards. The results agree within the limits of experimental error with the values as calculated from the quantum relation $h\nu = eV$, where ν is the frequency of the single radiation in the case of resonance potentials or the limiting frequency of the series of radiations in the case of ionization potentials.

The Validity of the Equation $P = dv/dT$ in Thermo-Electricity: Edwin H. Hall, Jefferson Physical Laboratory, Harvard University. The equation is known to be unverified experimentally. The author gives a brief, critical discussion of the validity of some theoretical proofs by which the equation has been deduced.

On the Equations of the Rectangular Interferometer: Carl Barus, Department of Physics, Brown University. A discussion under the under the headings of: Auxiliary Mirror, Rotating Doublet, Ocular Micrometer, Collimator Micrometer.

The Brain Weight in Relation to the Body Length and also the Partition of Non-Protein Nitrogen, in the Brain of the Gray Snapper (Neomœnis Griseus): Shinkishi Hatai, Tortugas Laboratory, Carnegie Institute of Washington and The Wistar Institute of Anatomy and Biology.

The Rotation and Radial Velocity of the Central Part of the Andromeda Nebula: F. G. Pease, Mount Wilson Solar Observatory, Carnegie Institution of Washington. The radical velocity —316 km. is found. The change of rotation velocity with distance from the center seems to be linear.

The second number of Volume 4 contains the following articles:

The Heat Capacity of Electro-Positive Metals and the Thermal Energy of Free Electrons: Gilbert N. Lewis, E. D. Eastman and W. H. Rodebush, Chemical Laboratory, University of California. The experiments go to indicate that in the metals considered the difference between the heat capacity observed and that calculated may be regarded as representing the actual heat capacity of the more loosely bound electrons in these metals.

Thermo-Electric Diagrams on the P-V-Plane: Edwin H. Hall, Jefferson Physical Laboratory, Harvard University. An analysis of the electro-motive force of a thermoelectric circuit on the assumption that the "free" electrons within the metals are the only ones moving progressively in the maintenance of a current, and the only ones taking part in thermo-electric action.

A Determination of the Solar Motion and the Stream Motion Based on Radial Velocities and Absolute Magnitudes: Gustaf Stromberg, Mount Wilson Solar Observatory, Carnegie Institution of Washington. The stream motion is probably a local effect caused by a preferential motion of the stars in both directions around the center of the stellar system. There appears to be a tendency towards smaller values of the declination of the sun's apex for the intrinsically faint stars.

Disease Resistance in Cabbage: L. R. Jones, College of Agriculture, University of Wisconsin. In every case the selected head strains transmitted in considerable degree their resistant qualities, and certain of them did so in high degree. A discussion of the results in their general significance is also given.

Is a Moving Star Retarded by the Reaction of its Own Radiation? Leigh Page, Sloane Physical Laboratory, Yale University. An extended analysis of the forces acting upon the electron leads to the conclusion that the moving electron, and hence any moving matter, suffers no retardation through its motion.

On Electromagnetic Induction and Relative Motion: H. S. J. Barnett, Department of Physics, Ohio State University. The experiments appear to support the hypothesis for the existence of the ether, and to be inconsistent with the principle of relativity.

National Research Council: Report of the Committee on Anthropology.

Notice of Biographical Memoirs: John Shaw Billings; By S. Weir Mitchell and Fielding H. Garrison.

The third number of Volume 4 contains the following articles:

The Effect of Artificial Selection on Bristle Number in Drosophila Ampelophila and its Interpretations: Fernandus Payne, Zoological Laboratory, Indiana University. There are, at least, two factors for extra bristle number, one of them located in the first, and one in the third chromosome.

The Reactions of the Melanophores of Amiurus to Light and to Adrenalin: A. W. L. Bray, Zoological Laboratory, Museum of Comparative Zoology, Harvard College. The melanophores in the skin of the *Amiurus* react to direct stimulation by adrenalin, and are subject to nervous control mediated through the eye.

Further Experiments on the Sex of Parthenogenetic Frogs: Jacques Loeb, Rockefeller Institute for Medical Research. The frogs produced by artificial parthenogenesis can develop into adults of full size and entirely normal character.

The Resolving Powers of X-Ray Spectrometers and the Tungsten X-Ray Spectrum: Elmer Dershem, Department of Physics, University of Illinois. The theory of resolving power is given with the results of experiments on tungsten, in which the endeavor was made to obtain as high a resolving power as possible.

Note on Methods of Observing Potential Differences Induced by the Earth's Magnetic Field in an Insulated Moving Wire: Carl Barus and Maxwell Barus, Department of Physics, Brown University. A simple apparatus is described, and an elementary estimate first given. The apparatus was then modified, producing intensification, and new observations were made.

Dependence of the Spectral Relation of Double Stars upon Distance: C. D. Perrine, Observatorio Nacional Argentino, Cordoba. There is an indication that some external cause is operating in more or less definite regions of our stellar system upon the conditions which produce spectral class.

Hypothesis to Account for the Spectral Conditions of the Stars: C. D. Perrine, Observatorio Nacional Argentino, Cordoba. The spectral condition of a star depends chiefly upon its size and mass and the external conditions of density of cosmical matter and relative velocities of star and matter.

National Research Council: Minutes of the thirty-fourth, thirty-fifth and thirty-sixth meetings of the Committee; war organization of the National Research Council.

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SPECIAL ARTICLES

TERNARY SYSTEMS AND THE BEHAVIOR OF PROTOPLASM

I

IN order to define more accurately the nature of certain changes which are observed in protoplasm (its normal water content, edema, cloudy swelling, fatty degeneration, necrosis) we have been continuing our study of the behavior of various simple colloids so far as their powers of hydration and dehydration are concerned under the influence of changes in their surroundings. Since the chemistry of the proteins is rather complicated, we have turned to a study of the colloid behavior of the chemically simpler soaps, for these show close analogy in their processes of hydration and dehydration to certain proteins. The soaps, however, behave in their turn much like mutually soluble systems of the type phenol-water-salt, and so we have passed from a study of the soaps to a study of these simpler physico-chemical systems. From these we have then built backwards through the soaps to the proteins and from these to the properties of living cells. The study as a whole makes clearer, we think, the nature of various changes which are observed in living matter. Many of the "vital" phenomena of cells may be interpreted in the terms of the behavior of simple hydrophilic colloids. These in turn, may be interpreted as expressions of the changes to be observed in systems of mutually soluble materials (like two liquids and a solid, a liquid and two solids, etc.) more particularly the changes incident to their "separation" in their "critical realms" with the accompanying changes in viscosity, in light transmission, in state of "solvent" or "dissolved" substances, etc.

II

Our studies on soaps not only corroborate the work of various well-known authors (Hofmeister, Lewkowitch, Krafft, Merklen, Goldschmidt, Botazzi, Victorow and Leimdörfer), but amplify their studies in that we worked with pure (salt-free) soaps and with longer series of such while subjecting them to more widely varying external conditions than is the case in most of the investigations thus far reported.

We began with the preparation of equimolar amounts of various salt-free soaps in the presence of a definite volume of water. For this purpose we neutralized (at the temperature of boiling water) the proper fatty acid with an equivalent of the proper alkali in a unit volume of water. When not otherwise speci-